

ENERGETICS AND MODERN PROBLEMS.

Die Forderung des Tages. By Wilhelm Ostwald. Pp. vi+603. (Leipzig: Akademische Verlagsgesellschaft m. b. H., 1910.)

IN Goethe's "Maximen und Reflexionen" there occurs the passage: "Versuche deine Pflicht zu tun, und du weisst sogleich was an dir ist. Was aber ist deine Pflicht? *Die Forderung des Tages.*" The author of the present volume tells us that this passage expresses the spirit in which he has from time to time, particularly during the last few years, attempted the solution of problems quite outside the sphere of his original scientific activity. These problems cropped up in the course of the day's work, and, so far as the author was personally concerned, imperatively demanded a solution. The numerous articles and speeches here collected represent Prof. Ostwald's views on the most varied questions, such as personality, immortality, the relation of art and science, the theory of happiness, science and technology, duelling, international languages, and educational reform. These and many other topics are discussed in a highly stimulating manner, the originality of the author's argument being equalled only by the charm of his style and the wealth of illustration which he has at his disposal. If one accepts the definition of a professor as given by "Fliegende Blätter"—"der Professor ist ein Mann welcher anderer Meinung ist"—it may readily be granted that the author, with his refreshing novelty of view, has fully earned the title.

The point of view from which all problems are regarded is the one natural to the apostle of energetics, whose attitude towards the more general questions of philosophy and psychology has already been outlined in these columns (*NATURE*, 1902, vol. lxx., p. 265). As the years have passed, however, Prof. Ostwald has been led to study the bearing of energetics on questions which touch more closely the life of the modern community, and are certainly of greater interest to the ordinary student of science and scientific method.

If, with the author, we measure culture by the extent to which the various sources of energy are economically utilised for human purposes, then it is natural to test the claims of every custom, every social organisation, and every educational system by the inquiry, How far does it contribute to the economical utilisation of energy? It might be supposed that the mental attitude of one who applies this test to all human endeavour is hopelessly utilitarian. But this is not true of Prof. Ostwald, who is concerned to find a place in his scheme of things for the higher and less immediately practical forms of man's activity. In this connection the question of the utility of works of art is of great interest. Prof. Ostwald, it appears, makes a hobby of painting, and we may be sure that he would at once forbid himself this activity if he considered it to involve a waste of energy. What, then, is a work of art, say a great painting, from the point of view of energetics? According to the present volume, the social value of such a work of art depends on its catalytic action, on its effect in making us better and happier beings, and so contributing to the more efficient transformation

of energy in our daily tasks. This point of view is greatly in advance of the ultra-materialistic one from which a great painting is merely so much canvas, so much oil, and so much pigment, but it is doubtful whether the comparison with catalysis is anything more than a mere analogy.

The prominence still given to the study of languages in schools is condemned in no measured terms, and the time devoted to Latin and Greek is described as a sacrifice to a superstition. It is quite truly pointed out that the learning of even a modern language, with its innumerable exceptions to rules, tends to destroy the child's natural sense of logic and to unfit it for any future scientific work. From this position it is but a step to the advocacy of an artificial international language, which shall be "synthesised" on a thoroughly logical plan, and shall obviate the necessity of learning foreign languages. It is the economy of energy to be secured in this way that has led Prof. Ostwald to take a prominent part in urging the adoption of Ido, a simplified form of Esperanto.

"*Die Forderung des Tages*" is pervaded by a genial optimism, based on the belief that the future of the race is in the hands of science alone. The optimism is welcome, although one might be inclined to argue about the grounds for it. It may be noted only in passing that Prof. Ostwald's belief leads him to the curious conclusion that the chauffeur belongs to a distinctly higher order of being than the "cabby."

Throughout the book there are scattered many delightful reminiscences of the author's experiences at home and abroad. These only add to the interest and charm of a volume which is well worth reading whatever one may think of energetics.

J. C. P.

THE INDUSTRIAL REVOLUTION.

Industrial England in the Middle of the Eighteenth Century. By Sir H. Trueman Wood. Pp. xii+197. (London: J. Murray, 1910.) Price 5s. net.

WE have in the volume before us an extremely interesting sketch, expanded from an address by the author given at a meeting of the Society of Arts, of the condition of British industries in the eighteenth century. Perhaps no two periods in the history of social evolution, which followed one another closely, present greater contrast than the beginning of the eighteenth and the beginning of the nineteenth centuries. Indeed, so enormous was the change involved that Sir Henry Wood considers it rather as an "industrial revolution" than a stage in a process of evolution.

The invention of machinery, then the discovery of power to work that machinery, entirely altered the character of the industries of this country, and thus so modified the lives of its inhabitants that it is no wonder that social equilibrium is still far from being attained. Before entering into a very able discussion of the state of the various branches of industry up to the middle of the century, Sir Henry gives us a vivid description of the social conditions then prevailing with regard to the means of intercommunication, and the knowledge of scientific applications for doing the work of the industrial world.

He then begins with an account of the various branches of the textile and other trades, deeply interesting, not only to those desiring a knowledge of their history, but to all students of the economic position at that time. One curious fact impresses itself on the mind of the reader, that is, how greatly the development of trade was hindered by the very means used to encourage certain particular trades which were protected by Government action. There was certainly no *laissez-faire* in those days.

The most important and most ancient of British manufactures was the woollen industry. It was in a state of great prosperity in the eighteenth century, and was even down to 1770 a domestic industry carried out in the homes of the farmers, who produced the wool, and carded, spun, and wove it into cloth by the help of their families and servants. Nearly all farmers depended on this industry to enable them to pay their rent. For its protection enactments were passed to prevent the export of the raw material; laws were also passed to prevent the mixture of cotton and wool or of linen and wool in weaving fabrics. It was to prevent competition with this valuable trade that one of the Parliaments of that period killed the Irish woollen trade, particularly its blanket trade, by putting an import duty on its goods. Sir Henry Wood does not mention this fact, but he states that the encouragement given to the Irish linen industry was to prevent that country entering into competition with England. In the eighteenth century, as now, Ireland and Scotland seem to have been the chief manufacturers of linen.

Probably it was owing to these repressive regulations that England was one of the last countries to adopt the manufacture of cotton. The skill of her spinners was only equal to producing very coarse cotton yarns. Beautiful muslins and calicoes were imported from India, and became so popular that in 1760 it was made "penal for any woman to wear a dress made of India calico." The wearing of French cambrics was also penal. One of the most fascinating sections of this volume contains the description of the gradual growth of the cotton industry as machinery was invented and perfected.

The making of linen and afterwards of cotton thread was first initiated in the west of Scotland by a woman named Christian Shaw; it rose to be an important trade, even in the eighteenth century, and its products were largely imported to England for purposes of lace making, then chiefly carried on in Devonshire and Bucks.

At the beginning of the century under discussion the manufacture of iron was at a very low ebb. Carried out since Roman times by the use of charcoal derived from wood, it had almost declined entirely owing to the destruction of the woods, and consequent legislative restrictions. The author traces the gradual development of the use of coal for smelting, beginning about 1735, at Coalbrookdale, first of all.

At this same place the method of casting iron was discovered and practised. Sheffield and Birmingham were already making a reputation for metal goods, including pewter, which was much used as a substi-

tute for pottery. Until well into the middle of the century England was mainly dependent on France and Holland for the commonest kinds of earthenware.

Sir Henry Wood tells us that this period, until some time after the middle of the century, was not a happy one for science or for scientific development, and we therefore find that industries dependent on scientific knowledge, such as the making of glass and fine pottery, of brewing and other chemical processes, were in a backward state.

Enough has been said to show what a wealth of material has been skilfully put together, and this book forms a most trustworthy source of information when coming from one who is in such a position as the secretary of the Royal Society of Arts.

SPECTROSCOPY.

The Spectroscope and its Work. By Prof. H. F. Newall, F.R.S. Pp. 163+viii Plates. (London: Society for Promoting Christian Knowledge, 1910.) Price 2s. 6d.

ALTHOUGH classed as a manual of elementary science, this little volume will be found to cover a very wide range of the phenomena of spectroscopy. The opening chapters are occupied with the first principles of the undulatory theory, Newton's classic experiments, and the description of a simple spectroscopic outfit. In chapters iv. and v. the reader is introduced to the various types of emission spectra shown by radiations from various sources, and to the characteristics of absorption, including the solar fraunhoferic and chromospheric spectra. Chapter vi. deals very lucidly with the theoretical principles to be considered in the design of spectroscopic equipment, showing the relation between angular and linear dispersion, purity and resolving power of various dispersive media, &c. Coming next to the application of the spectroscope to definite branches of research, it is shown how, by the aid of large instruments of special design, the spectra of the stars may be studied, revealing their variation in chemical constitution. This naturally leads to the systems of classification which have been proposed to deal with the complex groupings. In describing the fluted structure of the third-type stars, such as α Orionis, it would have been more correct to speak of the maxima of absorption being nearest to the violet instead of saying that the brighter ends were towards the red, as it is usual to regard the heads of flutings as taken for reference to the positions of flutings. It is also perhaps unfortunate for the student that so much space should be given to the old, incomplete, and now little used classifications, while the more comprehensive and natural systems put forward of recent years are discussed in a few lines. The idea suggested on p. 81 that the maxima of the star Mira (*o* Ceti) are of the nature of a conflagration is scarcely to be recommended, especially when dealing with beginners, as the practically unchanging character of the spectrum of the star (apart from brilliancy) even at maxima precludes the probability of any such chemical changes as must accompany the production of flame.